

SCRAMBLED CODE LETTERS FOR PROGRESS REPORT 66  
PROJECT 1108-17

Company - Mill	Machine No.	Code Letter
The Chesapeake Corporation - West Point	1	—
Continental Can Company, Inc. - Hopewell	1	P
Crown Zellerbach Corporation - Baltimore	1	C
- Baltimore	2	T
- Bogalusa	4	E
- Dresden	1	J
- Lebanon	2	R
International Paper Company - Bastrop	1	F
- Bastrop	2	—
- Georgetown	1	D
- Georgetown	2	—
The Mead Corporation - Harrison	1	I
- Knoxville	1	K
- Lynchburg	2	U
- Sylva	1	Q
Muskingum Fibre Products Company - Coshocton	1	N
North Carolina Pulp Company - Plymouth	3	L
Olin Mathieson Chemical Corporation - Monroe	1	—
- Monroe	2	—
Cwens-Illinois Glass Company - Tomahawk	1	A
- Tomahawk	2	M
- Tomahawk	3	G
- Big Island	1	—
- Big Island	2	—
- Big Island	3	H
St. Joe Paper Company - Port St. Joe	1	O
Union Bag-Camp Paper Corporation - Savannah	2	S
West Virginia Pulp and Paper Company - Covington	6	B
- Covington	7	—
- Charleston	—	—

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

SUPPLEMENTARY REPORT ON CALIPER OF SINGLE-FACED  
BOARD

Project 1108-17

Progress Report 66

to

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

May 1, 1960

# THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

This report is supplementary to Progress Report 65 of the baseline study on corrugating medium entitled, "Continuous evaluation of corrugating medium" which provides a program whereby participating mills have the opportunity to submit rolls of medium on a regular weekly schedule for evaluation with regard to physical characteristics of the medium and of the single-faced board made from the medium. Specifically, each medium is evaluated for caliper, basis weight, and Concora flat crush. In addition each medium is fabricated into A-flute single-faced corrugated board on the Institute's corrugator to determine its runability in terms of speed and tension, and the single-faced board obtained at maximum speed with minimum tension is evaluated for its flat crush strength.

This report is an extension of the baseline study described above and is concerned specifically with the caliper and uniformity of caliper of the single-faced board fabricated from each roll of medium. Uniformity of caliper is generally considered to be another facet of the criteria used to evaluate the runability of corrugating medium, and the Technical Committee of the Fourdrinier Kraft Board Institute, Inc., has requested that a measurement of the uniformity of caliper be included as a part of the evaluation given each roll of corrugating medium.

The evaluation of the caliper and uniformity of caliper of the single-faced board made from each roll of corrugating medium was carried out using the five circular specimens that were subsequently tested for flat crush strength. Each specimen was five square inches in area. They were cut at intervals of approximately two feet along the central portion

of a strip of the single-faced board fabricated at maximum speed and minimum tension. On each of these five specimens, caliper measurements were made on five consecutive flutes and the caliper difference between consecutive flutes was calculated, there being four calculations of differences for each specimen. The twenty-five caliper measurements (five calipers on each of the five specimens) were averaged and are reported as the caliper for each sample of medium. Likewise, the twenty caliper differences between consecutive flutes (four caliper differences on each of the five specimens) were averaged, and the maximum, minimum, and average values are reported for each sample of corrugating medium.

The instrument for measuring the caliper of individual flutes of single-faced board consists of a bench-type thickness gage with a pressure foot  $3/8$  inch in diameter and an anvil consisting of a plane circular surface 2 inches in diameter. The pressure foot is attached to a dial indicator which can be read to 0.0001 inch. The load on the pressure foot is  $100 \pm 10$  grams. A caliper determination is made by inserting each five-square-inch circular specimen between the pressure foot and the anvil so that the foot rests on the second flute from one end of the specimen without touching either of the adjacent flutes. The  $3/8$ -inch diameter of the pressure foot permits it to contact only one flute with ease. The specimen is pressed gently against the anvil, and the reading is then recorded. As mentioned previously, five consecutive flutes through the center of each specimen are calipered in this way. It should be emphasized that these calipers may not necessarily correspond to regular caliper measurements because of differences in load and other variables.

Caliper data have been obtained on the single-faced board fabricated from each of the one hundred and thirty-three rolls of corrugating medium which were submitted for evaluation during the month of April. Also included for purposes of convenient reference are the single-face flat crush and runability data. The current machine averages for each test are summarized in Table I for Machines A through U. A graphical presentation of the current machine caliper averages on single-faced board is shown in Figure 1, and a similar presentation of the current machine averages for the caliper difference between consecutive flutes is given in Figure 2. The test results obtained on the individual rolls of medium submitted by each company are given in Tables II through XXII for Machines A through U, respectively.

It may be seen in Figure 1 and Table I that the average caliper results for the single-faced boards varied from a low value of 195.3 points for Machine T to a high value of 197.8 points for Machine O. Likewise, from the results given in Table I and Figure 2, it may be noted that the average caliper difference between consecutive flutes ranged from a minimum of 1.6 points for Machines H, L, and S to a maximum of 3.0 points for Machines J and O. The majority of the machines were associated with average caliper differences of two points or less. The differences in the area of three points may be excessive.

TABLE I  
SUMMARY OF CURRENT MACHINE AVERAGES  
April, 1960

Machine	Number of Rolls	Caliper, points	Caliper Difference Between Consecutive Flutes, points	Single-Face Flat Crush, p.s.i.
A	7	196.9	1.7	34.5
B	14	197.4	1.7	30.9
C	4	196.5	1.8	28.8
D	4	197.7	2.4	36.0
E	6	196.8	1.8	29.1
F	8	196.4	2.0	35.1
G	7	197.3	1.8	35.2
H	6	197.5	1.6	31.7
I	4	196.5	1.8	31.0
J	6	195.8	3.0	30.9
K	4	195.5	2.3	32.3
L	10	196.6	1.6	34.5
M	7	197.5	2.2	34.9
N	9	196.9	2.9	33.5
O	4	197.8	3.0	28.1
P	9	197.4	1.9	32.8
Q	4	197.1	2.0	31.9
R	2	196.5	2.0	35.8
S	8	196.0	1.6	33.3
T	4	195.3	2.8	33.4
U	6	197.1	1.8	31.9
Total	133			

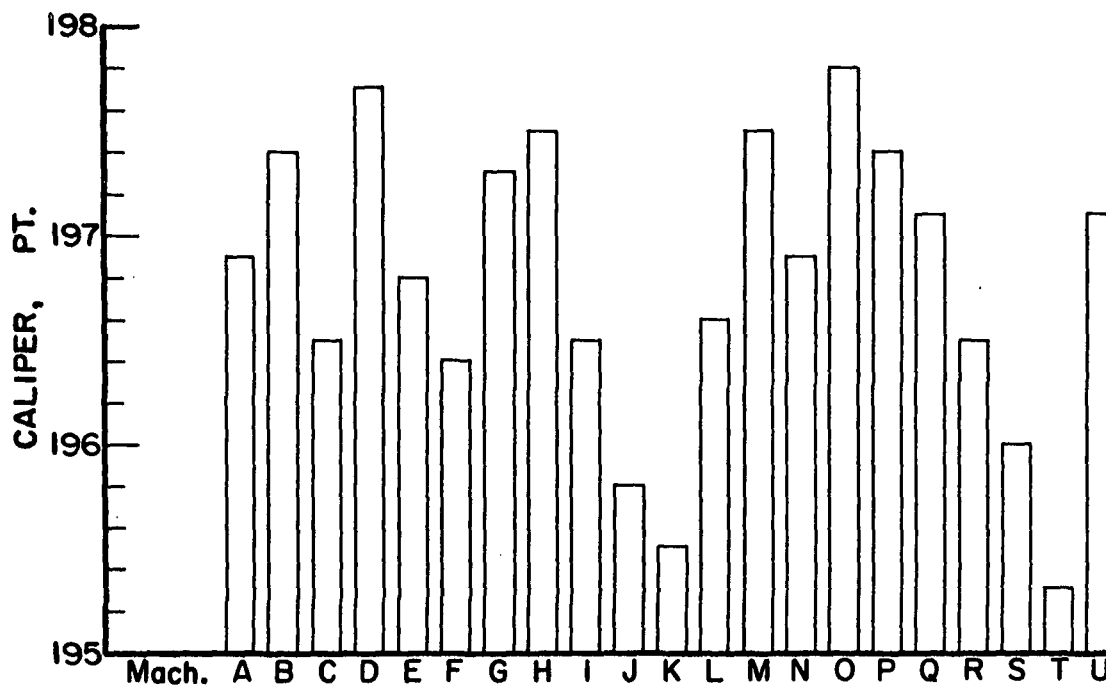


Figure 1

Comparison of Caliper Results on Single-Faced Board  
April, 1960

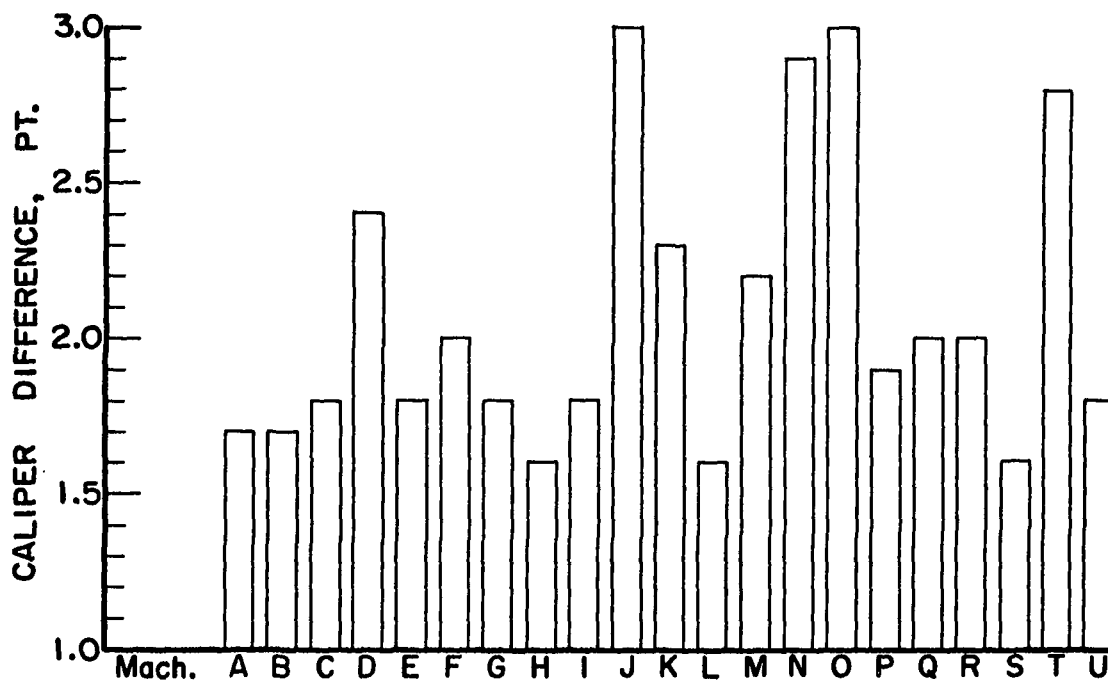


Figure 2

Comparison of the Caliper Differences Between Consecutive  
Flutes of Single-Faced Board  
April, 1960

TABLE II  
SUMMARY OF TEST RESULTS FOR MACHINE A  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
A-1	3-21-60	--	197.9	3.1	0.0	1.2	32.9	1-1/2
A-2	3-26-60	--	197.4	3.7	0.0	1.5	33.6	1-1/2
A-3	3-28-60	--	197.6	3.2	0.1	1.9	36.0	1-1/2
A-4	3-31-60	--	197.2	3.1	0.1	1.7	34.6	1
A-5	4- 7-60	--	195.4	4.2	0.1	1.6	35.4	1
A-6	4-11-60	--	196.4	4.6	0.1	1.4	35.2	1
A-7	4-14-60	--	196.2	4.6	0.4	2.6	34.0	1/2
Current Machine Av.			196.9			1.7	34.5	

TABLE III  
SUMMARY OF TEST RESULTS FOR MACHINE B  
April, 1960

B-1	2-19-60	72	197.9	4.8	0.4	2.2	29.2	1
B-2	2-22-60	73	196.2	2.9	0.2	1.7	32.6	1-1/2
B-3	2-29-60	74	197.8	4.4	0.1	1.8	29.9	1-1/2
B-4	3- 4-60	75	198.2	3.8	0.3	1.9	30.8	1-1/2
B-5	3- 6-60	76	198.1	2.7	0.5	1.4	30.7	1-1/2
B-6	3-10-60	77	198.6	4.2	0.2	1.9	30.5	1-1/2
B-7	3-16-60	78	197.0	3.2	0.0	1.4	31.1	1
B-8	3-17-60	79	197.8	2.6	0.0	1.1	29.1	1
B-9	3-21-60	80	197.6	3.9	0.3	2.1	31.6	1-1/2
B-10	3-24-60	81	197.3	4.5	0.3	2.2	32.1	1-1/2
B-11	3-29-60	82	197.0	3.1	0.3	1.5	31.4	1-1/2
B-12	4- 3-60	83	196.9	4.0	0.1	1.7	31.0	1-1/2
B-13	4- 5-60	84	196.3	2.9	0.1	1.5	31.9	1-1/2
B-14	4-12-60	85	196.7	4.7	0.0	2.0	30.4	1-1/2
Current Machine Av.			197.4			1.7	30.9	



TABLE IV  
SUMMARY OF TEST RESULTS FOR MACHINE C  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
C-1	3-20-60	13	195.9	4.7	0.1	1.7	29.6	1-1/2
C-2	3-21-60	14	196.5	7.4	0.0	2.4	31.9	1-1/2
C-3	3-30-60	15	196.5	2.7	0.4	1.2	26.9	1-1/2
C-4	3-31-60	16	197.0	3.8	0.0	1.8	26.7	1-1/2
Current Machine Av.			196.5			1.8	28.8	

TABLE V  
SUMMARY OF TEST RESULTS FOR MACHINE D  
April, 1960

D-1	3-17-60	391	199.0	3.6	0.1	1.6	32.0	1-1/2
D-2	3-22-60	392	198.8	4.6	0.2	2.2	35.9	1-1/2
D-3	3-24-60	393	197.1	8.5	0.1	3.5	36.8	1-1/2
D-4	3-31-60	394	195.8	6.3	0.3	2.3	39.2	1
Current Machine Av.			197.7			2.4	36.0	

TABLE VI

SUMMARY OF TEST RESULTS FOR MACHINE E  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Avg.		
E-1	3-22-60	38	196.9	5.8	0.1	2.1	27.5	1
E-2	3-24-60	39	195.9	4.4	0.1	2.0	27.8	Min.
E-3	3-30-60	40	197.6	2.7	0.1	1.2	32.6	Min.
E-4	4- 6-60	41	198.7	5.5	0.2	2.6	29.4	1
E-5	4-10-60	42	196.5	3.9	0.1	1.6	26.3	1-1/2
E-6	4-16-60	43	195.2	4.8	0.1	1.3	31.1	1
Current Machine Av.			196.8			1.8	29.1	

TABLE VII

SUMMARY OF TEST RESULTS FOR MACHINE F  
April, 1960

F-1	3-24-60	553	195.5	3.9	0.0	1.0	32.9	1-1/2
F-2	3-29-60	554	198.1	6.7	0.2	2.6	34.1	1-1/2
F-3	4- 1-60	555	198.1	3.7	0.0	1.6	37.4	1-1/2
F-4	4- 7-60	556	196.3	2.1	0.0	1.2	34.6	1-1/2
F-5	4- 8-60	557	196.8	5.4	0.9	3.1	35.6	1-1/2
F-6	4-12-60	558	195.8	4.7	0.4	2.0	34.6	1
F-7	4-15-60	559	195.2	4.7	0.2	2.4	36.3	1-1/2
F-8	4-19-60	560	195.8	5.2	0.3	2.2	35.6	1-1/2
Current Machine Av.			196.4			2.0	35.1	

TABLE VIII

SUMMARY OF TEST RESULTS FOR MACHINE G  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
G-1	3-23-60	--	198.4	3.0	0.2	1.2	34.3	1/2
G-2	3-26-60	--	198.0	5.6	0.0	1.7	35.9	1
G-3	3-30-60	--	196.8	4.0	0.2	2.2	36.6	1
G-4	4- 2-60	--	198.5	4.3	0.0	1.6	36.0	1-1/2
G-5	4- 9-60	--	196.3	4.9	0.1	1.6	34.6	Min.
G-6	4-15-60	--	195.6	3.1	0.0	1.8	33.0	Min.
G-7	4-16-60	--	197.2	4.4	0.0	2.2	36.0	1/2
Current Machine Av.			197.3			1.8	35.2	

TABLE IX

SUMMARY OF TEST RESULTS FOR MACHINE H  
April, 1960

H-1	1- 3-60	288	197.8	5.0	0.5	2.1	29.6	1
H-2	3- 1-60	92	198.8	3.4	0.2	1.3	29.5	1
H-3	3- 2-60	200	198.6	3.9	0.0	1.6	29.9	1
H-4	3-14-60	2314	196.5	3.7	0.2	1.4	32.8	1/2
H-5	3-16-60	2614	197.5	2.8	0.3	1.3	33.5	1/2
H-6	3-21-60	3463	195.7	4.3	0.1	1.9	35.0	1/2
Current Machine Av.			197.5			1.6	31.7	

TABLE X  
SUMMARY OF TEST RESULTS FOR MACHINE I  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
I-1	3-22-60	281	196.5	4.1	0.4	2.2	33.6	1
I-2	3-22-60	282	196.7	4.8	0.2	1.8	32.6	1/2
I-3	4- 6-60	289	196.4	3.4	0.6	1.8	28.6	1/2
I-4	4- 6-60	290	196.4	2.6	0.2	1.4	29.2	Min.
Current Machine Av.			196.5			1.8	31.0	

TABLE XI  
SUMMARY OF TEST RESULTS FOR MACHINE J  
April, 1960

J-1	3-25-60	29	194.9	5.6	0.0	2.2	31.2	1-1/2
J-2	3-25-60	30	195.3	6.7	0.0	1.8	30.7	1-1/2
J-3	3-29-60	31	199.1	11.8	0.1	3.3	30.7	1-1/2
J-4	4- 5-60	32	195.5	9.0	0.4	3.4	31.6	1-1/2
J-5	4- 6-60	33	195.2	6.5	0.4	3.5	31.2	1-1/2
J-6	4-13-60	34	195.0	8.9	0.1	3.6	29.9	1-1/2
Current Machine Av.			195.8			3.0	30.9	

TABLE XII

SUMMARY OF TEST RESULTS FOR MACHINE K  
(April, 1960)

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
K-1	3-24-60	283	196.2	4.7	0.0	2.1	31.8	1-1/2
K-2	3-24-60	284	197.1	5.7	0.0	2.9	29.2	1-1/2
K-3	4-13-60	291	194.0	6.2	0.1	2.0	34.3	1
K-4	4-13-60	292	194.6	5.6	0.0	2.2	34.0	1/2
Current Machine Av.			195.5			2.3	32.3	

TABLE XIII

SUMMARY OF TEST RESULTS FOR MACHINE L  
April, 1960

L-1	2-29-60	357	196.6	5.0	0.0	1.2	38.1	1/2
L-2	3-10-60	225	195.9	3.3	0.0	1.6	33.4	Min.
L-3	3-14-60	329	195.6	2.7	0.1	1.5	35.2	Min.
L-4	3-19-60	485	198.2	5.1	0.4	1.9	32.5	Min.
L-5	3-22-60	589	195.6	4.0	0.0	1.0	35.0	Min.
L-6	3-30-60	829	196.3	5.3	0.0	2.4	34.3	1/2
L-7	3-31-60	860	196.8	3.7	0.3	1.6	34.4	Min.
L-8	4- 1-60	3	196.8	4.2	0.2	1.9	33.4	1/2
L-9	4-6-60	173	197.7	4.2	0.2	2.0	33.6	1-1/2
L-10	4- 8-60	236	196.9	4.7	0.0	1.4	35.4	1/2
Current Machine Av.			196.6			1.6	34.5	

TABLE XIV

SUMMARY OF TEST RESULTS FOR MACHINE M  
(April, 1960)

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
M-1	3-22-60	--	198.0	4.1	0.0	1.4	37.8	1-1/2
M-2	3-25-60	--	199.1	4.5	0.0	1.8	34.8	1
M-3	3-29-60	--	197.0	4.4	0.2	1.6	36.3	1
M-4	4- 1-60	--	198.8	4.8	0.1	2.7	32.9	1-1/2
M-5	4- 8-60	--	196.5	6.5	0.1	2.7	35.1	Min.
M-6	4-12-60	--	196.5	5.5	0.0	2.5	35.2	1/2
M-7	4-13-60	--	196.5	5.5	0.0	2.4	32.4	1/2
Current Machine Av.			197.5			2.2	34.9	

TABLE XV

SUMMARY OF TEST RESULTS FOR MACHINE N  
(April, 1960)

N-1	3-18-60	318	196.9	8.0	0.8	3.7	34.6	1-1/2
N-2	3-19-60	319	198.4	5.5	0.6	3.4	32.6	1-1/2
N-3	3-23-60	320	197.8	7.8	0.5	3.3	31.8	1-1/2
N-4	4- 1-60	321	196.0	6.1	0.0	2.7	32.0	1-1/2
N-5	4- 1-60	322	195.7	9.1	0.4	3.8	33.0	1/2
N-6	4- 6-60	323	197.0	3.4	0.2	2.0	37.9	1/2
N-7	4- 6-60	324	197.2	6.2	0.7	3.4	35.8	1-1/2
N-8	4-13-60	325	197.0	6.0	0.1	2.6	31.2	1-1/2
N-9	4-14-60	326	196.5	5.5	0.0	1.6	32.5	1-1/2
Current Machine Av.			196.9			2.9	33.5	

TABLE XVI

SUMMARY OF TEST RESULTS FOR MACHINE O  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
O-1	3-12-60	9	195.7	10.2	0.4	4.8	27.8	1
O-2	3-12-60	10	196.9	7.0	0.0	3.6	26.8	1-1/2
O-3	3-12-60	11	199.4	5.2	0.1	1.8	29.8	1-1/2
O-4	3-12-60	12	199.4	4.9	0.1	1.9	28.0	1-1/2
Current Machine Av.			197.8			3.0	28.1	

TABLE XVII

SUMMARY OF TEST RESULTS FOR MACHINE P  
April, 1960

P-1	3-15-60	251	198.2	5.2	0.2	1.9	34.8	1-1/2
P-2	3-18-60	252	197.7	7.1	0.0	2.2	33.9	1-1/2
P-3	3-23-60	253	197.6	3.8	0.1	1.8	33.8	1-1/2
P-4	3-24-60	254	196.0	10.9	0.6	2.7	35.1	1-1/2
P-5	3-28-60	255	196.7	3.4	0.2	1.4	31.3	1-1/2
P-6	3-30-60	256	196.8	3.3	0.2	1.3	31.6	1-1/2
P-7	4- 4-60	257	196.8	3.8	0.2	1.8	30.4	1-1/2
P-8	4- 6-60	258	197.5	4.9	0.2	2.1	31.4	1-1/2
P-9	4-12-60	259	198.9	3.5	0.1	1.7	33.4	1-1/2
Current Machine Av.			197.4			1.9	32.8	

TABLE XVIII

SUMMARY OF TEST RESULTS FOR MACHINE Q  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Avg.		
Q-1	3-30-60	287	197.8	6.0	0.0	2.6	29.4	1-1/2
Q-2	3-30-60	288	199.3	4.5	0.0	1.8	32.6	1-1/2
Q-3	4-13-60	295	196.0	4.9	0.1	2.0	32.3	1
Q-4	4-13-60	296	195.4	4.1	0.1	1.7	33.3	1
Current Machine Av.			197.1			2.0	31.9	

TABLE XIX

SUMMARY OF TEST RESULTS FOR MACHINE R  
April, 1960

R-1	3-24-60	80	196.7	5.4	0.0	1.8	34.6	1-1/2
R-2	3-30-60	13	196.3	6.0	0.0	2.3	36.9	1-1/2
Current Machine Av.			196.5			2.0	35.8	

TABLE XX

SUMMARY OF TEST RESULTS FOR MACHINE S  
April, 1960

S-1	3-24-60	356	194.6	3.2	0.0	1.2	34.9	Min.
S-2	3-26-60	357	195.6	3.5	0.2	1.6	30.5	1/2
S-3	4- 4-60	358	194.0	4.9	0.1	3.1	32.2	Min.
S-4	4- 5-60	359	196.2	3.0	0.4	1.5	34.2	1/2
S-5	4- 9-60	360	196.0	3.4	0.0	1.1	32.0	1-1/2
S-6	4- 9-60	361	195.7	3.7	0.2	1.8	35.8	Min.
S-7	4-12-60	362	198.4	4.0	0.0	1.3	33.6	1/2
S-8	4-12-60	363	197.7	6.4	0.0	1.6	33.3	1-1/2
Current Machine Av.			196.0			1.6	33.3	



TABLE XXI

SUMMARY OF TEST RESULTS FOR MACHINE T  
April, 1960

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
T-1	3-19-60	13	195.2	7.2	0.5	3.2	29.6	1-1/2
T-2	3-20-60	14	195.9	7.9	0.1	3.2	30.4	1-1/2
T-3	3-31-60	15	194.8	5.8	0.3	2.5	37.2	1-1/2
T-4	4- 1-60	16	195.2	6.3	0.0	2.2	36.2	1-1/2
Current Machine Av.			195.3			2.8	33.4	

TABLE XX

SUMMARY OF TEST RESULTS FOR MACHINE U  
April, 1960

U-1	4- 7-60	277	197.6	4.8	0.3	2.0	31.5	1-1/2
U-2	4- 7-60	278	197.6	5.6	0.8	2.2	31.0	1-1/2
U-3	4- 7-60	285	196.8	3.7	0.0	1.8	31.6	1-1/2
U-4	4- 7-60	286	196.4	2.5	0.0	1.4	31.6	1-1/2
U-5	4-12-60	293	197.5	3.6	0.0	1.6	32.6	1-1/2
U-6	4-12-60	294	196.9	4.1	0.0	1.9	33.0	1-1/2
Current Machine Av.			197.1			1.8	31.9	

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